

Directly Retrieved Entire Clot from Forced Suction Thrombectomy Using the Penumbra System in Acute Middle Cerebral Artery Occlusion

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Although the Penumbra System (PS) is the most promising device in terms of recanalization rate, the PS cannot recanalize all cases, especially when clot is too hard, or if clot is located on tortuous segment of vessel. Under such circumstances, we simply modified the PS, identified certain advantages, and applied this as a primary modality for recanalization. Direct wedging between the tip of reperfusion catheter and the clot followed by forceful suction using a 50 cc syringe is a unique feature of this technique. Recently, a 45-year-old male of TICI 0 occlusion of the left MCA was completely recanalized (TICI 3) from single forceful suction of this technique. The interval from arterial puncture to revascularization was 12 minutes and 27 mm-sized entire clot was retrieved from the procedure.

Key Words : Acute; Penumbra System; Reperfusion; Stroke; Suction; Thrombectomy

The impact of early recanalization upon outcome in the management of acute ischemic stroke has already been stressed (1, 2). Currently available mechanical thrombectomy devices that have received US FDA clearance are the Merci Retriever (Concentric Medical, Inc, Mountain View, CA, USA) and the Penumbra System (PS) (Penumbra Inc, Alameda, CA, USA), which of both are indicated within 8 hours of symptom onset in patients with large intracranial vessel occlusion (3, 4).

To date, the most promising device in terms of

recanalization rate is the PS, which is designed for continuous disruption and aspiration of thrombi using a separator, reperfusion catheter, and aspiration pump (3). However, revascularization is not always possible despite usage of the PS, particularly when clots are too hard, so that the separator will not advance, or if clots are located on tortuous segment of vessel, in which case advancement of the separator can cause injury of surrounding endothelium. In our early experiences with the PS, we failed to recanalize a few cases due to the aforementioned situations; thus, we modified the standard PS technique which resulted in successful recanalization. Thereafter, the modified PS (mPS) technique, what is called forced suction thrombectomy, has been applied to major stroke patients admitted to our institutes. Here we describe a case of complete recanalization from single forceful suction of this technique.

CASE REPORT

A 45-year-old male had sudden onset left hemipare-

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Directly Retrieved Entire Clot from Acute MCA Occlusion

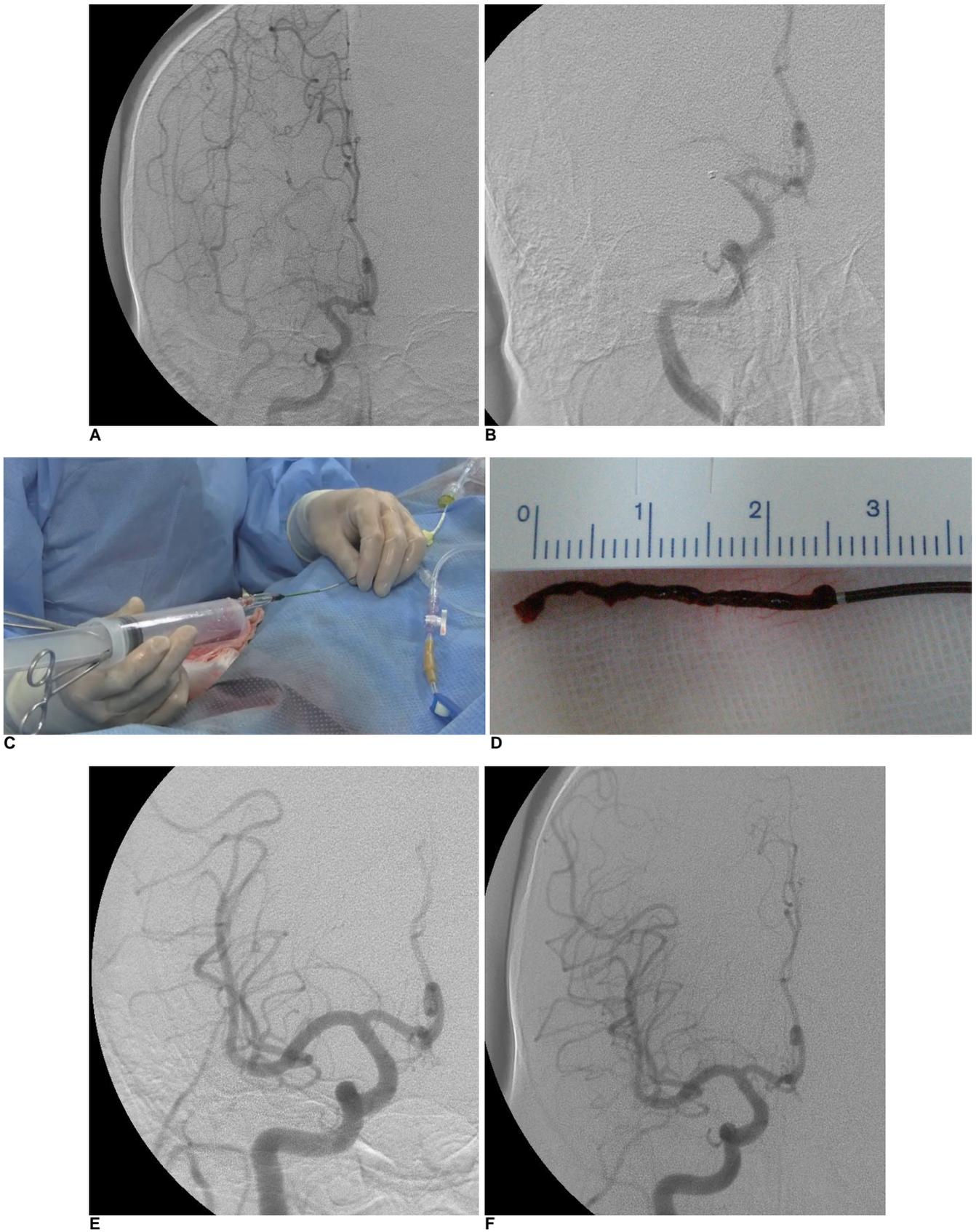


Fig. 1. A. Pretreatment angiography shows total occlusion (TICI 0) of the proximal M1 segment of the right MCA. B. Procedural angiography is showing “wedging” between tip of 041 Penumbra reperfusion catheter and the clot. C. A 50cc syringe connected to the proximal hub of the reperfusion catheter with forceful suction. D. 27 mm-sized entire clot which was retrieved during the procedure are shown. E and F. Immediate postprocedural angiographies show complete recanalization (TICI 3) of the occluded segment.

sis. CT findings were normal, and carotid angiography demonstrated complete occlusion (TICI 0) of the proximal M1 segment of the left MCA (Fig. 1A). Under diagnosis of cardioembolic stroke, immediate recanalization using the modified PS technique was performed 3 hours after onset of symptoms. We placed the guide catheter on the cervical segment of ICA, followed by advancing the 041 Penumbra reperfusion catheter to proximal part of the clots (Fig. 1B). After wedging the reperfusion catheter to proximal part of the clots, single forceful suction using a 50cc syringe enabled retrieval of 27 mm-sized entire clot (Fig. 1C and D), and resulted in TICI of 3 recanalization (Fig. 1E and F). The interval from arterial puncture to revascularization was just 12 minutes. No procedure related complications or intracranial hemorrhage occurred, and the patient improved in NIHSS score, from 20 at baseline to 14 at one day after the procedure.

DISCUSSION

Although the Phase 1 Penumbra trial showed a 100% revascularization rate to TIMI 2 or 3, the pivotal Phase 2 Penumbra trial recently reported an overall revascularization of 81.6% (3). Also, in our experiences of the standard PS, recanalization was not achieved in a few cases, particularly in the case of very hard thrombi and/or occlusion of severely tortuous segment. This prompted us to modify the technique while adopting as many of the advantages of the PS as possible, which included thicker but easily navigable reperfusion catheter and the concept of suction for revascularization. The modifications were simple and intuitive; first, usage of a reperfusion catheter as a vacuum pad to the thrombi; second, intensification of suction power via forceful pulling of syringe. The modified PS technique provided several benefits; first, it is simplification of the standard PS, thus, no additional manipulation or equipment is required and preparation time of the procedure is also shorter; second, revascularization can be achieved faster since the technique is brief; third, upon failure, conversion to the standard PS technique or to other procedures is easy.

This technique can be applied variously in clinical practice. We placed the present technique prior to the standard PS method. However, others can use this technique as a rescue or adjuvant procedure on occasions of failure to recanalize by the standard PS or other interventions.

Direct wedging between catheter tip and thrombi is a feature of this technique that requires some attentions. Reinforced suction power can injure the surrounding endothelium when the tip directly contact to vessel wall; therefore, careful interpretation of proximal and distal angiography is needed to predict original path of the occluded artery, and trying to keep the tip of reperfusion catheter parallel to the estimated path. In addition, slight pulling the plunger just prior to forceful suction is also required to confirm and strengthen direct wedging.

In conclusion, this case exemplifies the safe and effective recanalization of the present technique. It is a simple modification of the PS that simultaneously makes the best use of the PS. Based upon our experiences, the mPS technique allows for safe and in patients with acute ischemic stroke secondary to large vessel occlusion. It is brief and intuitive, and allows faster revascularization of the occluded vessel, and, upon failure, it can be easily converted to standard PS method or other interventions. Thus, the present technique is suggested as a viable option for acute stroke management, either by itself or in conjunction with other devices or drugs for achievement of the best outcome.

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Penumbra System을 응용한 흡인 혈전 제거술을 통해 전체 혈전이 한 번에 제거된 급성 중대뇌동맥 폐색 환자의 증례 보고

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본원에서는 Penumbra System을 응용한 흡인 혈전 제거술을 통하여, 한 번의 흡인으로, 전체 혈전이 통째로 제거된 증례를 경험하였다. 증례는 좌측 중대뇌 동맥 폐색으로 인한 급성 뇌경색으로, 시술 후 완전한 개통 소견을 보였다. 제거된 혈전은 그 길이가 27 mm였으며, 총 시술 시간은 12분이었다. 증례에 대한 보고와 동시에, Penumbra System을 응용한 흡인 혈전 제거술에 대하여 간략히 서술하였다.

Key Words : Acute; Penumbra System; Reperfusion; Stroke; Suction; Thrombectomy